The FHWA Travel Model Improvement Program Workshop over the Web

The Travel Model Development Series: Part I – Travel Model Estimation

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Webinar Outline

- Session 1: Introduction – October 16, 2008
- Session 2: Data Set Preparation – November 6, 2008
- Session 3: Estimation of Non-Logit Models – December 11, 2008
- Session 4: Estimation of Logit Models – February 10, 2009

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Webinar Outline (continued)

- Session 5: Disaggregate and Aggregate Validation Procedures – March 12, 2009
- Session 6: Advanced Topics in Discrete Choice Models – April 14, 2009
- Session 7: Highway and Transit Assignment Processes – May 7, 2009

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Webinar Outline (continued)

- Session 8: Evaluation of Model Validation Results – June 9, 2009
- Session 9: Real Life Experiences in Model Development, Webinar Wrap-Up – July 16, 2009

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The Model Validation Process

- One of the key concepts in model validation is that each component of a model must be validated individually
- Session 5 discussed validation of cross-classification, regression, gravity, and logit models
- This session deals with validating highway and transit assignment, and the overall model

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The New FHWA Model Validation Manual Is Coming!

- Later this year!
- More rejected titles for the new manual:
  - "Return of the Model Validation and Reasonableness Checking Manual"
  - "Revenge of the Model Validation and Reasonableness Checking Manual"
  - "Curse of the Model Validation and Reasonableness Checking Manual"
  - "Model Validation and Reasonableness Checking Manual – with a Vengeance!"

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Validation Includes a Lot of Things

- Checks of input data
- Reasonableness/logic checks
- Comparison of model results to independent data sources
- Sensitivity checks

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Highway Assignment
Types of Base Year Checks

- VMT
- Volumes
- Speeds

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Assignment is Route Choice

- Unlike some models such as mode choice, the outputs of assignment are not for the choice itself (route) but an aggregate computation from the choice.
- Therefore, only aggregate validation is performed although we may look at a fine level of detail (links).

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Highway Assignment
VMT Checks

- Observed vs. modeled – based on counts, segmented by (for example):
  - Functional class
  - Area type
  - Geography (e.g. counties)
  - Volume group

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Example Standards for VMT Checks

Acceptable % Difference from Observed

Roadway Type	FHWA (1990)	Michigan
Freeway	7%	6%
Principal Arterial	10%	7%
Minor Arterial	15%	10%
Collector	20%	20%

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Highway Assignment
VMT Checks

- Modeled vs. HPMS
  - Model adjustment required for non-attainment areas (http://www.bts.gov/smart/cat/vmt.html)
  - Need to account for local street VMT
  - By functional class, other (geography)

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Highway Assignment
VMT Checks

- VMT/household, per capita
  - Reasonable ranges
    - 40-60/HH, 17-24/per capita for large areas
    - 30-40/HH, 10-16/per capita for small areas

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Highway Assignment
Volume Checks

- Screenlines and cutlines
- Compare volumes on individual links with counts
- Root mean square error

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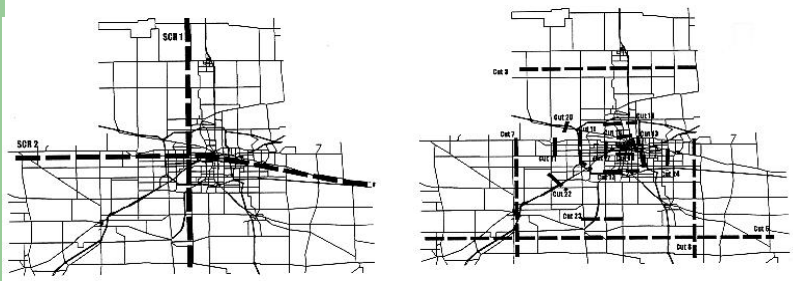
Screenlines and Cutlines



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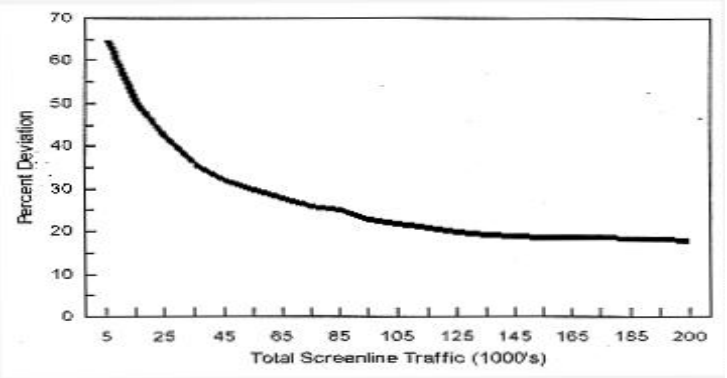
Example Standards for Screenline Checks

Remember this?



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Example Standards for Screenline Checks

- FHWA
  - ~65% for volume = 5,000
  - ~42% for volume = 25,000
  - ~30% for volume = 50,000
  - ~22% for volume = 100,000
  - ~18% for volume > 150,000
- Florida
  - 20% for volume < 35,000
  - 15% for volume 35,000-70,000
  - 10% for volume > 70,000
- Michigan: 5% for screenlines/10% for cutlines

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Root Mean Square Error

A measure of the differences between values predicted by the model and observed values

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} (V_{mod} - V_{obs})^2}{n}}$$

$$\% RMSE = \frac{RMSE}{\sum_{i=1}^{n} (V_{obs}) / n}$$

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Percent RMSE from U.S. Models
1990-2004

Ann Arbor	34%	Fort Lauderdale	36%	
Atlanta	27%	Lansing	28%	
Baltimore	30%	Massachusetts	35%	(statewide)
Boise	35%	Memphis	30%	
Cedar Rapids	29%	Norfolk	42%	
Charlottesville	22%	Phoenix	37%	
Chicago	47%	Raleigh	44%	
Cleveland	52%	San Diego	39%	
Dallas	43%	San Juan	39%	
Des Moines	48%	Tampa	46%	
Detroit	43%	Washington	50%	

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% RMSE Checks by Market Segment

- By volume group
- By facility type
- By geographic subarea

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What Do Validation Test Results Mean?

- Issues with the network?
- Issues with the trip tables?
- Issues with the assignment process?

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Network Checks Using Assignment Results

- Zero volume links
- Links with high volume/capacity ratios

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Highway Assignment
Speed Checks

- Observed vs. modeled by functional class
- Observed vs. modeled for major highways with observed speed data

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Volumes vs. Speeds
Which Do You Try to Get Right?

- Why is it hard to get them both right?
  - Volume-delay functions are simple
  - Link travel times independent of other links
  - Some factors affecting route choice not included
  - Speed data may be of lesser quantity and quality
- What do you need from the model?
- How do you use model results?
  - Post processing

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Highway Assignment
Forecasting

- VMT comparisons to base year
  - By functional class, area type, other (geography, etc.)
  - VMT/household, per capita
- Volume comparisons to base year
  - Screenlines
  - Major links
- Speed comparisons to base year

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Transit Assignment Validation

- Impossible to separate from mode choice aggregate validation
  - Assignment issues often related to inaccurate trip tables
  - Path building assumptions affect both mode choice and transit assignment
  - Assumptions about transfer rates, etc. from on-board surveys used in mode choice validation

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Transit Assignment
Check Estimated versus Observed

- Boardings for region by mode, time of day
- Boardings by route, group of routes, or corridor
- Transfers per trip
- Screenline volumes
- Estimated district-to-district transit trips

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Transit Assignment
Data Sources

- From transit operators
  - Boardings and alightings at transit stations
  - Route-specific boardings and fare collection data
- From surveys
  - Origin-destination data
  - Trip purpose
  - Auto availability and other demographic data
  - Access/egress modes
  - Transfers

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Assigning the Expanded Trip Table
From the Transit On-board Survey

- Do it during network development
- Check same things as for model trip tables assignment:
  - Boardings for region by mode, time of day
  - Boardings by route, group of routes, or corridor
  - Transfers per trip
  - Screenline volumes
  - Estimated district-to-district transit trips

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Transit Assignment
Forecasts

- Compare to base year ridership by
  - Route
  - Corridor
  - District
  - Screenline
  - Region

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Overall Model Validation

- The overall results are the results of the final step (assignment)
- But results may indicate things to check in earlier model steps:
  - Screenline issues → check trip distribution
  - VMT too high or low → check trip rates
  - Link volume issues → check networks

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Homework
Session 8

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